

3.1 Biodiversity

- **Biodiversity:** The number and variety of species and ecosystems on Earth
- By 2010, over 1.7 million kinds of living things had been identified
- Earth may be home to as many as 15 million different kinds of living things! (So why haven't we found them yet?)

Of all the species that have ever lived on Earth, how many are living today?

- less than 1%
- 1%
- 10%
- 20%
- 50%

0.1%, so in other words 99.9% of all species that have ever lived are extinct!

Greatest Mysteries: How Many Species Exist on Earth?

8.74 Million Species on Earth.

Census time again, but don't look for a form in the mailbox.

This census estimated the number of species on Earth.

Eight million, seven hundred and four thousand eukaryote species share this planet, give or take

1.3 million (Aug 23, 2011).

What is a Species?

- A **species** is a group whose members are able to freely breed among themselves under natural conditions
- Some plants, some fungi and micro-organisms only reproduce asexually, so traditional species definition does not apply
 - Use set of physical characteristics (**morphology**) to define them

Individual Variability

- A species is composed of individuals with different traits
- Individuals may show subtle differences...But...
- Still belong to the same species and are members of the same breeding population



humans

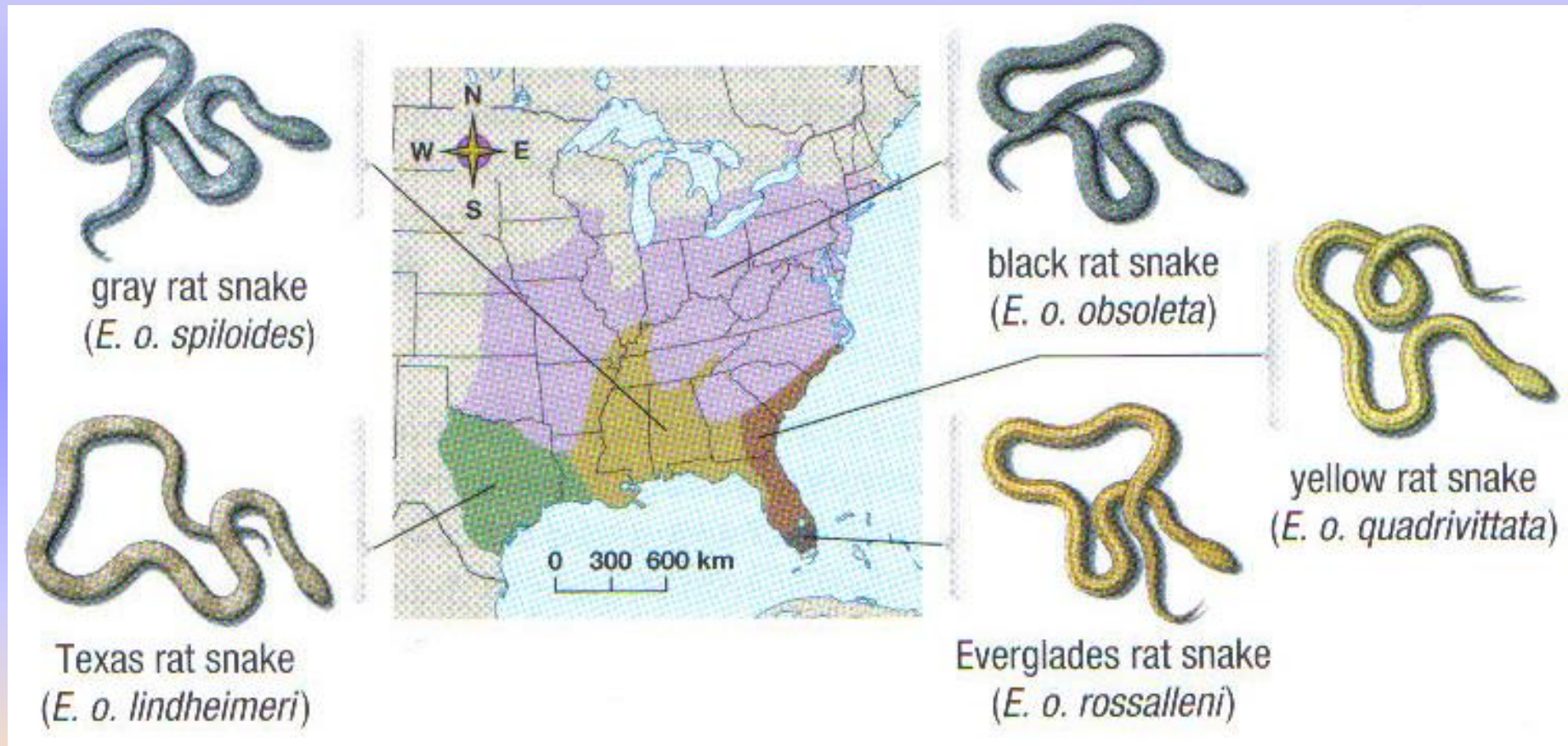
- Organisms in the same species can interbreed to produce viable offspring.



- These cannot....



- Species change over time and space.
They can evolve over many generations,
and they can change across continents
 - Five Subspecies of rat snake



Diversity in Ecosystems

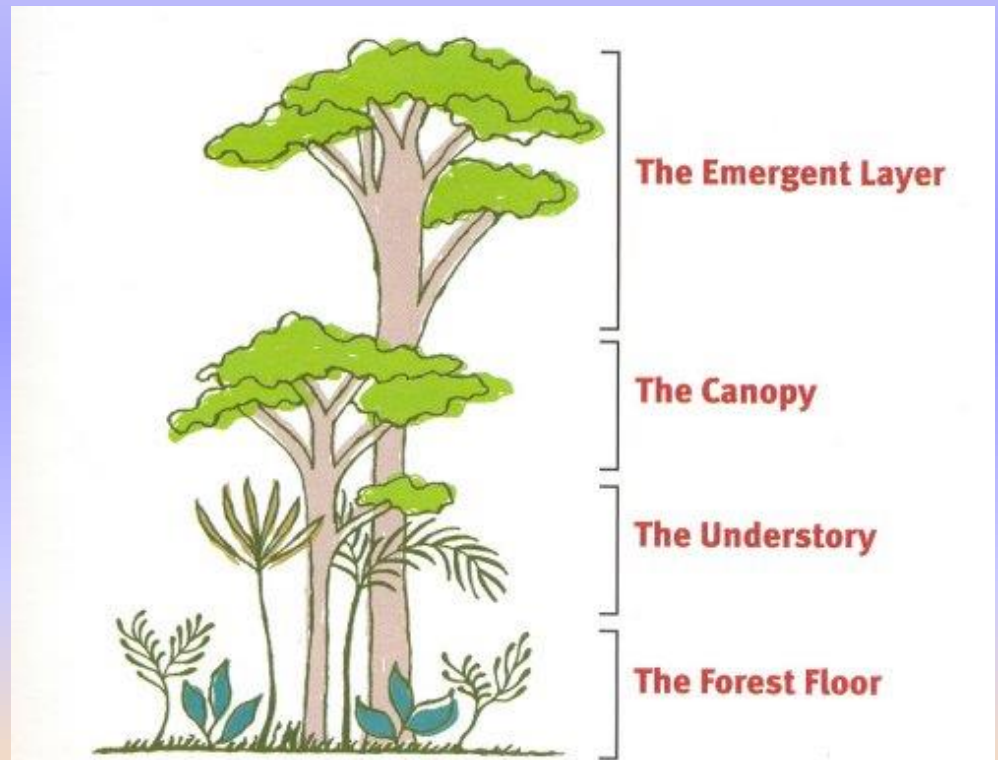
- Ecosystems are made up of many different species and their physical environments
- All species depend on other species for their survival:
 - Organisms that cannot make their own food (**heterotrophs**) feed on other living or dead organisms
 - Even organisms that make their own food (**autotrophs**) are dependent on other organisms

Diversity of Interactions

- Interdependence between species goes far beyond simple food chains and biogeochemical (?) cycles:
- Plant communities with high **species diversity** are better able to withstand disease, climate extremes and pests

Diversity of Habitats

- The range of physical sizes, shapes and distribution of the individuals, as well as habitats in an ecosystem are together referred to as **structural diversity**
- Structural diversity is critical for biodiversity because it creates microhabitats



The three levels of diversity:

1 - Species Diversity – refers to the number of species and their relative abundance. All species within an ecosystem have an important role in maintaining other species but also support the physical environment (preventing erosion), provide resources (food, lumber) and even support our social needs (research).

How does one species within an ecosystem influence another?

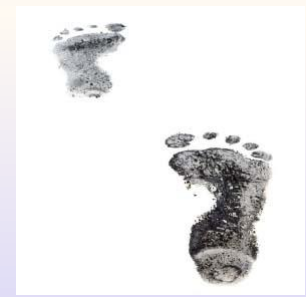


2) Genetic Diversity -Individuals in a population show variation because they have different combinations of genes and genetic mutations. This is essential for species' survival as environments change (for ex. A new infection kills some individuals while others survive – this allows the species to continue to survive).

3) Ecosystem Diversity – Ecosystems vary in their physical shapes and sizes and diversity of species present. Organisms tend to thrive in ecosystems with 'structural diversity'. It is important to maintain our environment as pollution or removal of resources (mining) destroy the ecosystem.



The Anthropocene



A term to describe the recent geological time period during which time humans have caused a major change to the planet.

Humans have changed the climate, reduced biodiversity and altered many ecosystems. The last mass extinction occurred 65 m.y.a.; many researchers think the Anthropocene marks another mass extinction.

Here are four examples of threats to biodiversity:

1. **Habitat destruction** – single greatest threat
2. **Introduced (invasive) species** – throw off ecosystem balance and disrupt community
3. **Overexploitation** – consumption of plants or animals at a rate that exceeds the ability of the species to rebound
4. **Disruption of Interaction Networks** – domino effect whereby the extinction of one species dooms others

Why does the loss of biodiversity matter?

Moral argument – respecting the life of other species is a key part of many religious and/or ethical belief systems

Crucial natural resource for humans in terms of crops, fibres, medicines, etc. For example: 25% of prescriptions in the U.S. contain plant-derived substances

Ecosystem services - all the processes through which natural ecosystems and the species they contain help sustain and maintain life on Earth e.g. purification of air and water, reduction in the severity of droughts and floods, decomposition of wastes, pollination of crops, cycling of nutrients, provision of beauty and recreational opportunities etc.



Biodiversity at Risk

- The loss of biodiversity:
 - Threatens our food supply
 - Eliminates sources of medicines
 - Economic impact on tourism and forestry
 - Potential to disrupt biogeochemical cycles by ecosystems (carbon, nitrogen...)
- Species extinction is a natural process. However....
- Human actions are resulting in a rapid loss of natural habitats from agriculture, forestry, urban expansion, invasive species and climate change
- Biologist E.O Wilson estimates that the current extinction rate may be 10 000 times greater than it would be without humans